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(54) COMPOSITION FOR ANTIREFLECTION FILM FORMATION

(57)Abstract:

PROBLEM TO BE SOLVED: To provide an antireflection film forming composition, having high power to absorb reflected light and capable of forming an antireflection film which has full resistance, even with respect to a developing solution on which a resist pattern excellent in shape can easily be formed at a high etching rate, even if the antireflection film is made thick and difference in level on a substrate is planarized.

SOLUTION: The antireflection film forming composition contains (A) at least one compound selected from among the compounds of the formulae represented by $\text{Si}(\text{OR}_1)_a(\text{OR}_2)_b(\text{OR}_3)_c(\text{OR}_4)_d$ (1), by $\text{R}_5\text{Si}(\text{OR}_6)_e(\text{OR}_7)_f(\text{OR}_8)_g$ (2) and by $\text{R}_9\text{R}_{10}\text{-Si}(\text{OR}_{11})_h(\text{OR}_{12})_i$ (3) and (B) a thermosetting resin which can be condensed with the component (A) and has absorbing power with respect to exposing light.

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CLAIMS

[Claim(s)]

[Claim 1] (A) Furring for photopolymers which contains matter which has absorbing power in a sensitization property wavelength region of a condensation product which was made to condense a diphenylamine derivative, formaldehyde denaturation, or a formaldehyde-alcoholic denaturation melamine derivative, and was obtained under existence of an acid catalyst, (B) water solubility or alkali fusibility resin, and the (C) photopolymer, and grows into it.

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

About furring for photopolymers, in more detail, using a photopolymer, in case field-of-the-invention this invention on industry performs pattern formation, it loses the adverse effect by the echo from a substrate substrate, and relates to photopolymer furring suitable as an object for pattern formation with high dimensional accuracy.

In manufacture of the semiconductor integrated circuit element which used the photopolymer (it is hereafter described as a photoresist), form the photoresist layer which consists of the organism which has photosensitive ability on a substrate, perform exposure and a development to this, a request pattern is made to form on a substrate, subsequently this substrate is etched by making this into a mask conventionally [Prior-art], and the method of forming the target circuit element is used.

By the way, the degree of integration of a semiconductor integrated circuit element improves every year, detailed-ization of the pattern size for ***** element formation is progressing to this, and since it corresponds to detailed-ization of this pattern, various amelioration is proposed also in lithography technology in recent years. The multilayer-resist method which made possible pattern formation with high dimensional accuracy as such a thing can be mentioned. For this, three layers can be divided into law and a two-layer method, and the former is law three layers, The organic membrane layer of the thick film aiming at flush-izing is formed on a substrate. After forming the thin film layer of an inorganic oxide on this, Furthermore, apply a photoresist on this and the resist layer by which patterning was carried out on the thin film layer of an inorganic oxide with the usual lithography technology is made to form. Although it is the method by which a pattern with very high dimensional accuracy is obtained by using this resist layer as a mask, etching an inorganic oxide layer, making a pattern imprint, and etching an organic membrane layer by using as a mask the inorganic oxide layer by which patterning was subsequently carried out It has three layers of this defect that the activity of law is complicated.

Moreover, although it is a method which has improved [above-mentioned] three layers of defects of law, and it is the method of etching an organic membrane layer by using this resist film as a mask, and imprinting a pattern after a two-layer method forms the organic membrane layer aiming at flattening on a substrate, makes a photoresist film form on it and carries out patterning of this, it has the problem produce INTAMIKISHINGU development, between an organic membrane layer and a photoresist film. On the other hand, also in exposure technology, the cutback projection aligner by the step-and-repeat method with which high resolution is obtained, and the so-called stepper are being introduced into the production line of a semiconductor device instead of the aligner of the contact method conventional in recent years. However, therefore, in 436nm and especially the lithography that used ** single wavelength when, it is easy to generate a standing wave on high reflective substrates, such as aluminum, and further, since this stepper also generates scattered reflection light in a level difference portion in addition to a standing wave to improve the light source or optical system, he has the defect that the dimensional accuracy of the pattern obtained is low, especially in formation of a detailed pattern in it. Then, as a method of improving such a defect, polyimide system resin be make into base polymer, the coat which consist of the material which mixed the extinction nature color to this be form on a substrate,

what prepared the photoresist film on it be use, and the method (JP,59-93448,A) of carrying out pattern formation with the usual lithography be propose. However, although it is effective in prevention of the standing wave generated on a substrate, and scattered reflection light, in order to use polyimide system resin unsuitable as an industrial use raw material for this method as base polymer, it is lacking in practicability.

namely, -- control of the process control for the solubility of the coat obtain tend to change and obtain a pattern with a good cross section configuration with the baking temperature at the time of coat formation, although polyimide system resin be widely use as an insulator layer material be very difficult, and it be only about **2 degrees C of proper temperature requirements for obtain a good pattern actually -- there be nothing -- fluctuation of the slight baking temperature like equipment at the time of BEKU -- the solubility -- **** intermediary stripes -- it may be unacquainted and have the big trouble. The greatest reason and greatest intermediary **** which are behind in utilization of this method in spite of accepting the effectiveness of the generating prevention effect of a standing wave and scattered reflection light for this trouble.

In order to solve such a problem, the method (JP,60-220931,A) using furring which replaced with polyimide system resin and used melamine system resin is proposed. Since there are few soluble baking temperature change dependencies and the generating prevention effect of a standing wave and scattered reflection light also has them, this material can obtain a pattern with a good cross-section configuration with sufficient dimensional accuracy. [high]

However, since this material has low solubility, the residue of the resin used for this furring tends to remain in the corner portion of a pattern and a substrate after pattern formation, and it has the defect that the cross-section configuration of a pattern tends to become at skirt breadth.

Thus, the conventional substrate material may not fully be satisfied practical and development of a soluble high material was desired [therefore] to baking temperature change that there is little soluble change.

It is made for the purpose of trouble this invention which invention tends to solve providing pattern formation with high solubility and high dimensional accuracy with little [and] soluble change to baking temperature change with useful furring for photopolymers in response to such want.

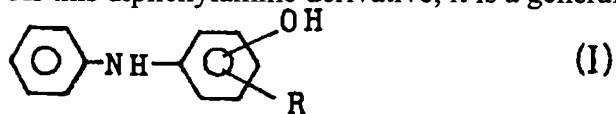
The means this invention persons for solving a trouble are ***** for finding out that that object can be attained and completing this invention based on this knowledge by using a specific melamine system condensation product, water solubility, or alkali fusibility resin as base polymer, as a result of repeating research wholeheartedly, in order to improve the defect which the aforementioned polyimide system resin has and to develop furring for photopolymers suitable as an object for pattern formation.

That is, this invention offers furring for photopolymers which contains the matter which has absorbing power in the sensitization property wavelength region of the condensation product which was made to condense a diphenylamine derivative, formaldehyde denaturation, or a formaldehyde-alcoholic denaturation melamine derivative, and was obtained, (B) water solubility or alkali fusibility resin, and the (C) photopolymer, and grows into it under existence of the (A) acid catalyst.

Hereafter, this invention is explained to details.

Therefore in this invention material, the condensation product used as a (A) component is obtained by making a diphenylamine derivative, formaldehyde denaturation, or a formaldehyde-alcoholic denaturation melamine derivative condense under existence of an acid catalyst.

As this diphenylamine derivative, it is a general formula.

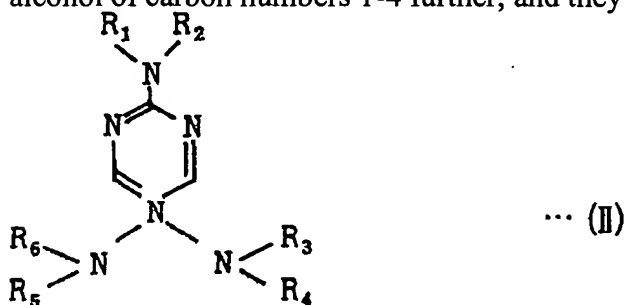


(R in a formula is a hydrogen atom or a hydroxyl group)

It comes out, and what is expressed is desirable, for example, can mention p-hydroxy diphenylamine, m-hydroxy diphenylamine, o-hydroxy diphenylamine, 2, 4-dihydroxy diphenylamine, 3, and 5-dihydroxy diphenylamine etc. These may be used independently, respectively, and two or more sorts may be

combined and they may be used.

Moreover, it is the thing which therefore denaturalized and methylol-ized the melamine with formaldehyde to the well-known method as formaldehyde denaturation or a formaldehyde-alcoholic denaturation melamine derivative, or the thing which carried out alkoxy ** of this using the lower alcohol of carbon numbers 1-4 further, and they are ***** and a usual general formula.



(At least one in R1, R2, R3, R4, R5, and R6 of a formula is a methylol radical, the remainder is a hydrogen atom or an alkoxy methyl group to which at least one piece changes from the alkyl group of carbon numbers 1-4, and the remainder is a methylol radical or a hydrogen atom)

Although it comes out and the mixture of the compound expressed and polymers, such as the dimer, trimer, etc., is used preferably, the alkoxy methyl group to which a methylol radical changes from the alkyl group of 2-4 pieces or carbon numbers 1-4 in R1-R6 of said general formula (II) especially is suitable for 1-4 denaturation melamine derivatives.

Since it is marketed as NIKARATSUKU (Sanwa chemical company make), NIKAREJIN (Nippon Carbide Industries Co., Ltd. make), etc., such a denaturation melamine derivative can come to hand easily.

Moreover, as an acid catalyst for obtaining a condensation product, although organic acids, such as inorganic acids, such as a hydrochloric acid, a phosphoric acid, and a sulfuric acid, a formic acid, and oxalic acid, can be mentioned, for example, the phosphoric acid from the point which can control comparatively easily whenever [condensation / which is related to the solubility of the condensation product obtained] in these catalysts, sulfuric acids, or especially those mixture are suitable. Moreover, although it changes with classes, concentration, etc. of an acid catalyst to be used and the amount of an acid catalyst cannot generally be specified, since the viscosity of reaction mixture increases this condensation reaction with progress of a reaction, a proper quantity of an acid catalyst is used so that the system of reaction may not be in the hyperviscous condition near solidification. When specifically using a phosphoric-acid aqueous solution as an acid catalyst 85% of the weight, it is desirable to use more than twice preferably tales doses or more than it mostly to the weight of the brewing raw material of a diphenylamine derivative and a melamine derivative.

Although it therefore is not necessarily fixed on the class or other conditions of a brewing raw material about reaction temperature, it is usually suitably chosen within the limits of 15-70 degrees C. Although this reaction is exothermic reaction, since a reaction will stop being able to go on easily if temperature is low by below the need in early stages of a reaction, it is desirable to hold before and behind near a room temperature in early stages, and to advance a reaction at an after that predetermined temperature, or to hold a predetermined temperature from the time of a reaction, and to advance a reaction. Moreover, if reaction temperature is high beyond the need, since a resultant has a possibility of gelling, it is not desirable.

Moreover, about the brewing rate of a diphenylamine derivative and a denaturation melamine derivative, if there are many amounts of a denaturation melamine derivative, the system of reaction will be [become] easy to tend gel with progress of a reaction, and the solubility of the obtained condensation product tends to fall. On the other hand, although gelation will stop being able to happen easily if the amount of a diphenylamine derivative increases, solubility tends to increase the obtained condensation product remarkably. Therefore, it is desirable to teach at a rate which has preferably 1 - 60 % of the

weight of amounts of a denaturation melamine derivative in 25 - 55% of the weight of within the limits to all raw material charges.

furthermore, the thing to which the polymerization degree of the condensation product obtained, so that reaction time was long is high, and macromolecule quantification progresses -- ** -- it is considered. Therefore, if reaction time is short, a soluble high product will be obtained, on the other hand, viscosity lifting takes place with progress of reaction time, and almost fixed viscosity is reached in 48 - 72 hours. Moreover, the solubility of the obtained condensation product tends to fall gradually with the length of reaction time.

Thus, the obtained condensation product shows solubility only to a certain limited special solvent system. such a special solvent system -- for example, polar solvents, such as a N-methyl-2-pyrrolidone, an N-acetyl-2-pyrrolidone, dimethyl sulfoxide, N-methyl formamide, dimethylacetamide, dimethylformamides, and such mixture, or said polar solvent, and this condensation product -- ** -- although an intermediary is nonsolvent, these polar solvents are partially aromatic solvents with a solvent with compatibility etc. Moreover, this condensation product has the feature that good solubility is shown to inorganic or an organic alkali solution.

As the water solubility or alkali fusibility resin used as a (B) component in this invention material dissolving in **, (1) water, or an alkali aqueous solution, and (2) -- dissolving in the solvent which dissolves said condensation product -- What fulfills conditions, like there are said condensation product and compatibility is desirable. (3) -- not having said condensation product and reactivity and (4) -- specifically Hydroxypropylmethylcellulose phthalate, hydroxypropyl-methylcellulose acetate phthalate, Hydroxypropyl-methylcellulose acetate succinate, hydroxypropyl-methylcellulose hexahydro phthalate, The hydroxypropyl methylcellulose, the hydroxypropyl methylcellulose, Hydroxypropylcellulose, hydroxyethyl cellulose, ethyl hydroxyethyl cellulose, Cellulose acetate hexahydro phthalate, a carboxymethyl cellulose, Cellulose type polymers, such as carboxy methyl ethyl cellulose, ethyl cellulose, and methyl cellulose, N,N-dimethylacrylamide, dimethylaminopropyl methacrylamide, N and N-methylenebis acrylamide, butyl acrylamide, N,N-dimethylaminopropyl acrylamide, N-methylacrylamide, diacetone acrylamide, dimethylaminoethyl methacrylate, Diethylamino ethyl methacrylate, N, and N-dimethylamino ethyl acrylate, the acrylic obtained from acryloyl morpholine, an acrylic acid, etc. and an acrylamide system polymer, or the copolymer which combined at least two or more kinds among these -- or These at least one kind and styrene, ethyl acrylate, methyl methacrylate, A copolymer with vinyl acetate etc., a polyvinyl pyrrolidone, polyvinyl alcohol, The copolymer of a polyvinyl formal, the methyl vinyl ether, and a maleic anhydride, the copolymer of styrene and a maleic anhydride, the copolymer of an isobutylene and a maleic anhydride, the copolymer of vinyl pyrrolidone and vinyl acetate, etc. can be mentioned. These may be used independently, and two or more sorts may be combined and they may be used.

Such water solubility or alkali fusibility resin has that desirable the molecular weight of whose is 10,000 to about 200,000 5000 or more, especially in order to make a good coat form.

Moreover, about the blending ratio of coal of this water solubility or alkali fusibility resin, it is desirable to usually blend in 1 - 30% of the weight of the range preferably 1% of the weight or more to said condensation product. If the effect of this invention is not fully demonstrated at less than 1 % of the weight but these loadings, on the other hand, exceed 30 % of the weight, since the inclination which the solubility over the alkali aqueous solution of a formation coat becomes high too much, and soluble control becomes difficult, and serves as a pattern with the big amount of undercuts at the time of development arises, it is not desirable. Moreover, when these loadings increased and multilayer spreading is carried out, between photoresist layers, a medium mixture layer may be formed and it is not desirable from this point.

By combining said condensation product and water solubility, or alkali fusibility resin, even if solubility is high and sets the material of this invention as proper baking temperature, it can give a coat with little soluble change resulting from the baking temperature which changes delicately.

In this invention material, in order to prevent the scattered reflection by the irregularity on the standing wave therefore produced from a substrate to an echo as a (C) component, or the front face of a substrate,

the matter which has absorbing power in the sensitization property wavelength region of the photopolymer to be used is added. As such matter ** 7, for example, a coumarin, a coumarin 314, a coumarin 338, quinoline yellow, "Magneson and BARIFUASUTOIERO AUM] made from ORIENT Chemistry, BARIFUASUTOIERO 4220 [the product made from ORIENT Chemistry], the OPURASU yellow 136 [the product made from ORIENT Chemistry], "SUMIPU last yellow H5G] by Sumitomo Chemical Co., Ltd., the SUMIPU last yellow HLR [the Sumitomo Chemical Co., Ltd. make], the OREOZORU fast yellow GCN [the Sumitomo Chemical Co., Ltd. make] and the macro REKUSU yellow 3 -- G [the Bayer make] --] by macro REKUSU yellow 6G[Bayer, kaya set orange G [the Nippon Kayaku Co., Ltd. make], Colors, such as] [by kaya set yellow 2G[Nippon Kayaku Co., Ltd.], kaya set yellow GN [Nippon Kayaku Co., Ltd. make], and oil yellow 18 [product made from SHIRADO Chemistry] p-hydroxy-p'-dimethylaminoazobenzene, can be mentioned. And these may be used independently, and two or more sorts can be mixed and they can also be used. Respectively, such a color is good to add five to 40% of the weight preferably 1% of the weight or more to this condensation product, in order to have characteristic solubility and to demonstrate the acid-resisting effect effectively. a possibility of depositing at the time among a solution of spreading even if the acid-resisting effect is not fully demonstrated, and it will not dissolve thoroughly if many [too] or it will dissolve, if there are too few these amounts -- ***** -- it is not desirable.

In the spreading liquid obtained by dissolving this invention material in an organic solvent, various kinds of surfactants aiming at amelioration of a spreading disposition top or a striation can be added according to a request. as such a surfactant -- for example -- uni--- dyne DS-401 (Daikin Industries, LTD. make), Sir chlorofluocarbon SC-103, SR-100 (Asahi Glass Co., Ltd. make), EF351 (northeast fertilizer company make) Fluorad Fc-431, Fc-135, Fc-98, Fc-430, Fc-176 (Sumitomo 3 M company make), RIPARU OH104 P-K (the LION fats-and-oils company make), Turkey red oil, etc. can be mentioned, and 50-10000 ppm of additions are practically chosen especially in 50-2000 ppm preferably to the amount of solid content in spreading liquid.

Moreover, in order to raise the adhesion over the substrate of the coat formed from this invention material, a silane coupling agent etc. may be added according to a request.

Next, if one example of the suitable operation of furring for photopolymers of this invention is explained, after first carrying out revolution spreading of the spreading liquid which dissolved in the organic solvent and prepared this invention material for example, on the substrate with a spinner etc., preferably, and 120-170 degrees C of furring for photopolymers are formed. [the temperature of 135-160 degrees C] If baking temperature becomes lower than this range, since the solubility over a developer will become remarkably high and the amount of undercuts will increase, if it becomes conversely high preferably, since solubility worsens and the residue of the resin which constitutes furring for photopolymers serves as a pattern of skirt breadth being easy to remain, it is not desirable. As BEKU time amount in this case, it is usually a 60 - 300-second about room preferably for 60 - 600 seconds. Moreover, as a BEKU means, the BEKU means by the hot plate from the point that the controllability of baking temperature is high is desirable. In addition, the above-mentioned baking temperature range is a range obtained in the upper surface of a hot plate using the surface thermometer of a contact mold.

Next, it is although a photoresist layer is prepared on the obtained substrate material for photopolymers after BEKU processing, The photoresist marketed now can be used as this photoresist, and OFPR series [the TOKYO OHKA KOGYO CO., LTD. make], OMR series [the TOKYO OHKA KOGYO CO., LTD. make], ONNR series [the TOKYO OHKA KOGYO CO., LTD. make], AZ series (cyripedium rhe company make), KPR (product made from KODATSUKU), OEBR series [the TOKYO OHKA KOGYO CO., LTD. make], etc. can be mentioned as such a thing, for example. The positive type photoresist of a quinone diazide system or a naphthoquinonediazide system and the negative-mold photoresist of a rubber system are especially desirable.

Moreover, in case the substrate material for photopolymers of this invention applies a photoresist on it, does not have the need for surface treatment, either and has the feature that it can apply immediately. Especially this shows that it is effective as furring in photoresist film formation of multilayer structure.

Furthermore, when furring for photopolymers of this invention is used, the upper layer which touches directly the layer which consists of this substrate material for photopolymers does not necessarily need to be a photoresist, for example, may prepare the thin film of a metal or an inorganic substance on this substrate material layer for photopolymers in the three-layer resist method, and may make a photoresist form on it further.

In order that this invention material may show good solubility to a specific organic solvent and inorganic, or an organic alkali solution, when it melts this material to a specific organic solvent, apply it on a substrate, a coat is made to form and the positive type photoresist layer of alkali fusibility is formed on it, by one development, it can form an etching mask pattern on a substrate and can cancel the complicatedness of the process which is the defect of the conventional multilayer resist method.

The substrate material for photopolymers of effect-of-the-invention this invention has very little soluble change resulting from the baking temperature of the formed coat compared with the conventional material, since the allowance width of face of baking temperature change is wide, there is no need for especially strict baking temperature control, and since the solubility over a developer is good, a sharp pattern with high dimensional accuracy can be given.

An example, next an example explain this invention to details further.

Example 1 of reference If the manufacture p-hydroxy diphenylamine of a condensation product and an m-hydroxy diphenylamine are mixed at a rate of 9:1 by the weight ratio, the total amount of 1910g is dissolved in 6.0kg of phosphoric-acid solutions at 50 degrees C 85% of the weight and it dissolves thoroughly, the solution is cooled to 30 degrees C.

Independently, NIKAREJIN S305 (the Nippon Carbide Industries Co., Ltd. make, formaldehyde denaturation melamine derivative) and 955g are added in the water of this and tales doses, and the NIKAREJIN aqueous solution in which it was made to dissolve at 40 degrees C is prepared.

It is made to react, while a tap funnel is used and this NIKAREJIN aqueous solution is dropped at said solution in about 30 minutes. Under the present circumstances, it is dropped so that the temperature of reaction mixture may not go up rapidly for heat of reaction. After dropping termination and after making it react at 50-80 degrees C for 5 to 20 hours, a reactant is deposited by adding reaction mixture into 30l. pure water. Subsequently, after carrying out dehydration processing with a dehydrator, it washes with 30l. water again. The aqueous ammonia of concentration is made to neutralize about 10% at this time. After dehydrating furthermore and dissolving this in the 8-% of the weight aqueous solution of tetramethylammonium hydroxide, reaction generation resin is deposited by making a hydrochloric-acid aqueous solution neutralize 10% of the weight. This is dehydrated, a washing-dehydration process is repeated 4 times, and the condensation product of reaction generation resin is obtained by making it dry using the vacuum freeze dryer after washing termination.

Next, it dissolved in dimethylacetamide, the condensation product obtained by doing in this way was condensed, and it ****ed to concentration 12% of the weight. And what added magneson 3.6g was made into the sample 1 as matter which has absorbing power in 100g of this solution in the sensitization property wavelength region of a photopolymer. Moreover, what added SUMIPU last yellow H5G (Sumitomo Chemical Co., Ltd. make)3.6g was made into the sample 2.

Example 2 of reference After using the monomer shown in the 1st table of manufacture of water solubility or alkali fusibility resin, teaching isopropyl alcohol as a monomer, water, and a chain transfer agent in a 3l. 3 TSU openings flask and warming at 45 degrees C, 2 and 2'-azobis (2-amidinopropane) 2 hydrochloride is added 2% of the weight to a monomer as a water-soluble radical polymerization initiator, and a reaction is started. After making it react for 4 hours, keeping reaction temperature at 60 degrees C, water solubility or alkali fusibility resin was manufactured by raising reaction temperature to 80 degrees C, and making it react for 1 hour. Subsequently, after having distilled off under reduced pressure of the water in reaction mixture, putting in the liquid after distilling off into the acetone of that amount of about 10 times and depositing resin until the amount of this reaction mixture decreased about to 1/5, the monomer currently mixed into the generated resin was flushed. And by dissolving and condensing the resin which added dimethylacetamide and deposited, water and an acetone were removed and the resin solution of dimethylacetamide was obtained.

第 1 表

試料	モノマー	モノマー量 (重量%)	イソプロピルア ルコール(g)	水の量 (g)	合成樹脂の分子量 (GPC測定)
3	N,N-ジメチルアクリルアミド	10	180	1620	8万
4	//	//	90	1710	17万
5	ジアセトンアクリルアミド	//	180	1620	10万
6	//	//	90	1710	20万
7	N,N-ジメチルアミノプロピルメタクリルアミド	10	180	1620	5万
8	N-メチルアクリルアミド	//	//	//	11万
9	//	//	90	1710	15万

試料	モノマー	モノマー量 (重量%)	イソプロピルア ルコール(g)	水の量 (g)	合成樹脂の分子量 (GPC測定)
10	N,N-ジメチルアミノエチアクリレート	//	//	//	11万
11	アクリロイルモルホリン	//	//	//	14万
12	//	//	180	1620	8万
13	アクリル酸+N,N-ジメチルアクリルアミド	5+5	//	//	13万
14	//	3+7	//	//	10万
15	アクリル酸+スチレン	9+1	90	1710	6万

The water solubility or 3.0g of alkali fusibility resin obtained in the example 2 of reference was added in 103.6g of solutions containing the matter which has absorbing power in the sensitization property wavelength region of the condensation product and photoresist which were obtained in examples 1-27 and the example 1 of the example reference of a comparison, and spreading liquid was prepared in them. On the substrate which vapor-deposits aluminum and changes on the 4 inch silicon wafer which has the level difference of 1 micrometer for this spreading liquid, furring for photopolymers was formed by BEKU [creating 4-6 substrates which carried out revolution spreading by 4000rpm with the spinner, respectively, / each substrate / setting plate temperature as 145 degrees C, 150 degrees C, 155 degrees C, 160 degrees C, 165 degrees C, and 170 degrees C, and] for 5 minutes using a hot plate.

Subsequently, the photoresist film which carries out revolution spreading of the OFPR-5000 (TOKYO OHKA KOGYO CO., LTD. make) which is a positive type photoresist on it, and has 1.35-micrometer thickness about each was formed. [110 degrees C] [for 90 seconds] Next, after using cutback projection aligner 4800DSW (GCA company make) and performing alternative exposure processing, quiescence paddle development for 45 seconds was performed at 23 degrees C using the tetramethylammonium hydroxide aqueous solution 2.38% of the weight, a photoresist and furring for photopolymers were removed selectively simultaneously, and the pattern was formed.

Thus, with the electron microscope, the residue of the resin which constitutes the substrate material [in / for the obtained pattern / the corner section of the amount of undercuts, a pattern, and a substrate] for photopolymers was observed with each baking temperature. The result is shown in the 2nd table.

Moreover, it is ***** about observation with the same said of that by which water solubility or alkali fusibility resin is not added for the comparison.

Consequently, there is no residue in an undercut and the corner section, or the thing using this invention material is **** in ** also as *****. On the other hand, it was checked that the residue in an undercut and the corner section produces that by which water solubility or alkali fusibility resin is not added

according to the difference of baking temperature, and it was confirmed that the property cannot change [this invention material] easily to change of baking temperature.

In addition, after BEKU [the dissolution rate in a table (A/second) / the baking temperature of 140 degrees C] for 5 minutes, it is measuring the thickness of the residual membrane which is immersed in a tetramethylammonium hydroxide aqueous solution (23 degrees C) 2.38% of the weight, and is obtained, and it asked for it from the relation between thickness and immersion time amount.

Moreover, a code means a degree.

HPMCP (H.P.-50) : hydroxypropylmethylcellulose phthalate HPMCAP : In a hydroxypropyl-methylcellulose acetate phthalate pan, the judgment of the existence of the amount of undercuts and the existence of the residue in the corner section is ***** to the following criteria.

amount of undercuts: -- O: -- very many O: -- many **: -- little x: -- some [those / very little / of the corner section with residue:O, and / **:] -- a ***** and x -- nothing

第 2 表

実施例	縮合体 試料	水溶性又はア ルカリ可溶性 樹脂試料	縮合体に対する水溶性 又はアルカリ可溶性樹 脂の添加量(重量%)	溶解速度 (Å/秒)	ベーク温度 (°C)	アンダ ーカッ トの量	コーナ ー部 での残渣量 の有無
1	1	3	20	500	145 150 155 160 165 170	△ △ × × × ×	× × × × × ○

実施例	縮合体 試料	水溶性又はア ルカリ可溶性 樹脂試料	縮合体に対する水溶性 又はアルカリ可溶性樹 脂の添加量(重量%)	溶解速度 (Å/秒)	ベーク温度 (℃)	アンダ ーカッ トの量	コーナ一部 での残渣量 の有無
2	1	4	10	370	145 150 155 160 165 170	△ △ × × × ×	× × × × × ○
3	1	4	20	520	145 150 155 160 165 170	△ △ × × × ×	× × × × × ○
4	1	4	30	680	145 150 155 160 165 170	△ △ × × × ×	× × × × × ○
5	1	5	10	410	— 150 155 160 — 170	— △ × × — ×	— × × × — ○
6	1	5	20	600	— 150 155 160 — 170	— △ △ × — ×	— × × × — ○
7	1	6	20	520	— 150 155 160 165 170	— △ × × × ×	— × × × × ○
8	1	7	20	450	— 150 155 160 165 170	— △ × × × ×	— × × × × ○

実施例	縮合体 試料	水溶性又はア ルカリ可溶性 樹脂試料	縮合体に対する水溶性 又はアルカリ可溶性樹 脂の添加量(重量%)	溶解速度 (Å/秒)	ベーク温度 (℃)	アンダ ーカッ トの量	コーナ一部 での残渣量 の有無
9	1	8	10	430	145 150 155 160 — —	△ × × × — —	× × × △ — —
10	1	8	20	580	145 150 155 160 — —	△ × × × — —	× × × △ — —
11	1	9	20	530	— 150 155 160 165 170	— △ × × × ×	— × × × × ○
12	1	10	10	300	145 150 155 160 — —	△ × × × — —	× × × △ — —
13	1	10	20	530	145 150 155 160 — —	△ × × × — —	× × × △ — —
14	1	11	20	500	— 150 155 160 165 170	— △ × × × ×	— × × × △ ○
15	1	12	20	550	— 150 155 160 165 170	— △ × × × ×	— × × × × ○

実施例	縮合体 試料	水溶性又はア ルカリ可溶性 樹脂試料	縮合体に対する水溶性 又はアルカリ可溶性樹 脂の添加量(重量%)	溶解速度 (Å/秒)	ベーク温度 (°C)	アンダ ーカッ トの量	コーナ一部 での残渣量 の有無
16	2	13	10	540	145 150 155 160 — —	△ × × × — —	× × △ △ — —
17	2	13	20	490	145 150 155 160 — —	△ × × × — —	× × × △ — —
18	2	HPMCP(HP-50)	10	300	145 150 155 160 165 —	△ × × × × —	× × × △ ○ —
19	2	HPMCP(HP-50)	15	400	145 150 155 160 165 —	△ × × × × —	× × × △ ○ —
20	2	HPMCP(HP-50)	20	460	145 150 155 160 165 —	△ × × × × —	× × × △ ○ —
21	2	HPMCP(HP-50)	25	590	145 150 155 160 165 —	△ △ × × × —	× × × △ ○ —
22	2	HPMCP	10	330	145 150 155 160 — —	△ × × × — —	× × × △ — —

実施例	縮合体 試料	水溶性又はアルカリ可溶性 樹脂試料	縮合体に対する水溶性 又はアルカリ可溶性樹 脂の添加量(重量%)	溶解速度 (Å/秒)	ベーク温度 (℃)	アンダー カットの量	コーナー部 での残渣量 の有無
23	2	//	20	490	145 150 155 160 — —	△ △ × × — —	× × × △ — —
24	2	イソブチレン- 無水マレイン 酸共重合体	20	530	145 150 155 160 — —	△ △ × × — —	× × × △ — —
25	2	13	20	470	— 150 155 160 165 170	— △ × × × ×	— × × × × ○
26	2	14		420	145 150 155 160 165 170	△ △ × × × ×	× × × × × ○
27	2	15	20	400	145 150 155 160 165 170	△ △ × × × ×	× × × × × ○
比較例	1	なし	—	260	145 150 155 160 165 170	◎ △ △ × × ×	× △ △ ○ ○ ○

[Translation done.]